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R&D

25X

June 14, 1965

Ref: 1007/E

P. O. Box 6788  
Fort Davis Station  
Washington, D. C. 20020

Declass Review by NGA.

Reference: Your Letter of May 11, 1965

Gentlemen:

accepts the changes as specified in your letter of May 11, 1965, with the following understandings:

- 1 - has incurred since inception of this contract, developmental costs in the areas of RFI, film coding, etc. It is our understanding that these charges will be allowable in accordance with the terms and conditions of this contract.
- 2 - In order to eliminate any confusion as to exactly what is implied in your letter of May 11, 1965 has prepared a First Revision, dated May 21, 1965, to the Performance Requirements for High Resolution Step and Repeat Contact Printer.

Therefore, if the revised specifications, plus our understandings listed in this letter are acceptable to you, it would be appreciated if you would authorize to proceed with Phase 3 of the contract.

The changes as agreed to by our respective technical representatives are presently being reviewed to determine the effect on the project's price and delivery.

"This material contains information affecting the national defense of the United States within the meaning of the espionage laws, Title 18, U. S. C., sections 793 and 794, the transmission or revelation of which in any manner to an unauthorized person is prohibited by law."

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June 14, 1965

Ref: 1007/PLI-82

Should any additional questions on this subject arise, please do not hesitate to contact [redacted] or the undersigned.

25X

Very truly yours,

CONTROL DIVISION

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[redacted]  
Contract Administrator

TKL:sm

Enclosures: As Listed

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**CONFIDENTIAL**

December 16, 1963

First Revision: May 21, 1965

PERFORMANCE REQUIREMENTS  
FOR  
HIGH RESOLUTION STEP AND REPEAT CONTACT PRINTER

1. SCOPE

- ✓ 1.1. Scope--These performance requirements cover a high-precision, automatically operated, step and repeat contact roll printer, capable of producing photographic exposures of the highest possible quality, resolution, and acutance from roll film widths varying from 70 mm to 9 $\frac{1}{2}$  inches in any selected frame lengths from 5 inches up to a maximum of 30 inches.
- ✓ 1.2. Development Plan--The development plan shall be carried out in the following three phases:
  - ✓ 1.2.1. Feasibility Study--The contractor shall submit a feasibility report for approval. The report shall present the characteristics and components required to meet the performance requirements specified herein and the proposed methods of accomplishment.
  - ✓ 1.2.2. Breadboard Phase--The breadboard phase shall demonstrate the feasibility of the concepts employed. The breadboard model shall be reviewed and approved by the contract monitor before proceeding with fabrication of the prototype. Approval of the breadboard shall not relieve the contractor of his responsibility to fulfill the requirements specified herein.

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- ✓ 1.2.3. Prototype Phase--The prototype phase shall encompass final design, fabrication, and testing of the finished deliverable product.

## 2. REQUIREMENTS

- ✓ 2.1. General--The automatic step and repeat contact printer specified herein shall be an electrically operated, single-unit, enclosed, darkroom loading, daylight operating floor model requiring no installation other than connection to an electric power source and to an external exhaust vent. The principal use of the printer will be to produce duplicate contact prints on roll film from aerial roll negatives.
- ✓ 2.1.1. The prime objective of this development is to produce a printer capable of the maximum modulation transfer function, in terms of the modulation transfer characteristics of the reproduction material, with a reasonably high recycling rate and an operating flexibility to permit multiple exposures from a single negative frame and selective printing of single frames.
- 2.1.2. Automatic exposure control is required. Automatic dodging in conjunction with exposure control is desirable but not a firm requirement.

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- ✓ 2.1.3. Frame Selection--The printer shall be designed so the operator, by the proper setting of appropriate controls, may cause the negative film to be transported any required distance, up to 500 feet and to stop automatically in the proximity of the desired frame. It shall also be possible to cause the negative film to be transported automatically to any desired frame on the negative. Methods of implementing these features should include, but not be limited to, (1) frame separation sensing, both with and without a "not to exceed" distance for use in case of "butted" or overlapped frames; (2) a four-digit footage counter, with a provision for starting from zero or any other number as a datum on the footage counter; (3) a frame counter, where the operator presets, by switches or similar means, the number of frames to be indexed starting with zero or any other number as a datum on the frame counter; or (4) a normal slew control which transports the film only while the operator actuates the control. The printer shall also permit visual verification of the entire frame by the operator.

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- ✓ 2.2. Materials--All materials employed in the printer shall be of the highest quality and shall be corrosion resistant or properly treated to resist corrosion.
- ✓ 2.3 Cabinet Enclosure--The entire printer shall be contained within a single protective cabinet. The function of the cabinet shall be to provide a daylight operating unit having a clean room interior atmosphere, during its operation. The cabinet shall be as small as possible, consistent with the requirements.
  - ✓ 2.3.2. Interior Environment--The cabinet shall be pressurized with filtered air to prevent entry of dust particles. Input air shall be filtered to a particle size not greater than 0.3 micron in diameter. The printer will operate properly in a room environment of approximately 70° to 80° F and a relative humidity of 55% to 70%.
- 2.4. Film Accommodation--The printer shall properly accommodate the following in all respects:
  - ✓ 2.4.1. Film Widths--70 mm, 5 inch, 6.6 inch, 8 inch, and 9.5 inch.

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- ✓ 2.4.2. Film Lengths--Film rolls up to 500 feet of negative film and print film, respectively. It shall be a design objective to handle film rolls up to 1,000 feet.
- ✓ 2.4.3. Film Thicknesses--From 2.0 to 7.5 mils.
- ✓ 2.4.4. Representative Film Types--8430, 5427, 8402, and S0130
- ✓ 2.4.5. Spools--"Mil Standard" flanged spools of required flange diameters to accommodate the films described under Paragraphs 2.4.1. to 2.4.4., inclusive. If MIL Standard spools do not exist, standard commercially available spools will be used.
- ✓ 2.4.6. Paper Accommodation--Deleted
- ✓ 2.4.7. Film Perforations--Perforated film will not be used. Duplication film will be blue sensitive only. No panchromatic films will be used.
- ✓ 2.5. Print Format--The printer shall produce prints (in dynamic mode) in nominal format sizes from a minimum of  $2\frac{1}{4} \times 5$  inches to a maximum of  $9\frac{1}{2} \times 30$  inches, as well as selected intermediate format sizes. Masks along the width of the film may be used to eliminate edge data when so desired. The mask edge image need not be sharp, and the adjustment of the mask will be manual.

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- ✓ 2.6. Printing Rate--The print rate shall be no less than 10 frames per minute, and the specified requirements for maximum quality shall be maintained. For purposes of demonstrating printing rate, a minimum output density of 0.05 above base fog shall be produced on 5427 duplicating film (processing in accordance with manufacturer's recommendation), using a uniform input density of 2.5. Resolution may be demonstrated on a high resolution film, such as S0-105 or S0-267.
- ✓ 2.7. Evenness of Illumination--Evenness of illumination shall be such that the illuminance at the film gate shall not vary across the film width by more than 5%. Measurement of evenness of illumination may be made photometrically.
- ✓ 2.8. Resolution--The printer, in its dynamic mode, shall be capable of consistently producing exposures of not less than 400 lpm from original targets of 1000:1 contrast ratio and resolving a minimum 800 lpm. This resolution requirement shall apply over the entire format of each specified size. In the event that original targets of 800 lpm of 1000:1 contrast ratio are not available, it will be sufficient if 400 lpm can be demonstrated with any input target of over 400 lpm. Microdensitometer traces will be made; however, measurement of the resolution will be accomplished visually.



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- ✓ 2.9. Contrast--The printer shall produce a contrast slope of not less than 1.35 when exposed to an A-1 step tablet original on Type 8430 film and processed according to manufacturer's recommendations.
- ✓ 2.10. Splice Accommodation--The printer shall accommodate film rolls with film splices of the type normally used by principle manufacturers of aerial film and good quality hand splices.
- ✓ 2.11. Newton Rings--Provisions shall be made to prevent Newton rings from affecting the photographic quality of the output.
- ✓ 2.12. Film Damage--The printer shall not damage the film base or emulsion of original negative or print material in any manner whatsoever, including damage that may be caused by static electricity.
- ✓ 2.13. Film Contact--The printer shall provide near absolute contact over the entire printing format at all cycling rates and all operating modes.

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- ✓ 2.14. Distortion--Prints from the printer shall not differ dimensionally from the original negatives in any direction by more than .01% with respect to the original at any place in the format, excluding distortion introduced by processing.
- ✓ 2.15. Film Cleaning--The negative and duplicating films will be furnished pre-cleaned and will require no further cleaning.
- ✓ 2.16. Reliability--The printer shall be designed for a 90% duty cycle and shall operate satisfactorily and properly in all respects for continuous periods of not less than 10 hours without malfunction or breakdown while transporting both negative film (leader) and print film (leader). After the endurance run, the printer shall produce prints meeting the requirements specified herein.
- ✓ 2.17. Human Engineering--The printer design and fabrication shall exhibit the highest possible degree of human engineering consistent with the specified requirements.
- ✓ 2.18. Vibration--Suitable vibration isolation shall be provided for the printer and its significant components to minimize adverse effects of vibrations from external sources and from internal sources.

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✓ 2.19. Light Source--The light source or light sources shall be entirely suitable, appropriate, and adequate for the purpose to fulfill the prime requirements of maximum print quality, resolution, and acutance.

✓ 2.19.1. It is suggested that consideration also be given to:  
(Not firm requirements)

✓ 2.19.1.1 Collimation of the light source or sources

✓ 2.19.1.2 Interchangeability of light sources to facilitate selection of sources with peak emissions corresponding to the sensitivity of materials being exposed.

✓ 2.19.1.3 Deleted

✓ 2.19.1.4 A traveling light source across the length of the print frame.

✓ 2.19.1.5 Sources that permit modulation and/or attenuation for purposes of print dodging and/or exposure control.

✓ 2.19.1.6 Optical compensators or correctors to achieve even illumination.

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- ✓ 2.20. Automatic Exposure Control--The printer shall have appropriate, accurate, and automatic exposure control capable of properly compensating for overexposed and/or underexposed original negatives.
- ✓ 2.21. Automatic Dodging--(Not a firm requirement.) It is desired that an automatic dodging capability also be incorporated in the printer. It would be highly desirable to combine the automatic dodging capability with the automatic exposure control. This capability, however, shall not detract from the prime requirements for maximum quality, resolution, and acutance.
- ✓ 2.22. Control Panel--The printer shall have a suitable control panel properly recessed in the cabinet enclosure but readily accessible. All controls shall be appropriately marked.
  - ✓ 2.22.1. Indicators--The control panel shall include indicators for lamp brightness or equivalent.
  - ✓ 2.22.2. Printer Controls--All controls necessary for satisfactory and proper operation of the printer shall be provided. These shall include a capability for automatic multiple printing of any number of duplicate prints from one (1) to forty (40) from any selected negative frame; automatic single or multiple printing of any preset number of frames; and manual control to allow unlimited selective printing of selected frames.

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- ✓ 2.22.3. Reverse Winding--Provision shall be made for bi-directional winding of the negative material within a reasonable time at a speed approximating 100 fpm.
- ✓ 2.22.4. Print Counters--Two counters shall be provided. One shall be a six (6) digit non-resettable counter for counting the total lifetime recycling of the printer. The second shall be a four (4) digit resettable counter for counting the prints exposed in any given run.
- ✓ 2.23. Electrical Requirements--The printer shall operate from a 120-208 volt, 60 cycle, 3 phase, 4-wire power supply. Data showing required electrical data shall be securely affixed in a conspicuous place near the main power input to the printer.
- ✓ 2.23.1. Safety Interlocks--Suitable safety interlocks shall be provided in the printer to preclude any possible damage to original materials (negatives) in case of printer malfunction, film break, or material run-out.
- ✓ 2.23.2. Fusing--The printer and its major operating components shall be provided with suitable circuit breakers to prevent damage to the printer in the event of electrical failure.

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- ✓ 2.23.3 Color Coding--All electrical wiring shall be color coded to permit circuit tracing.
- ✓ 2.23.4 Circuit Diagram--A circuit diagram shall be permanently affixed to an accessible interior panel of the printer.
- ✓ 2.23.5 Voltage Stabilization--Proper and adequate voltage stabilization shall be provided within the printer to assure consistent and stable functioning of all operational components.
- ✓ 2.23.6 Radio Interference Suppression--All reasonable efforts will be made to reduce radio frequency interference to a minimum. Reduction of RFI will not be carried out to the extent that costs of components, design, or fabrication are greatly increased as a result. Also, the RFI reduction must not result in hampering the operation of the device or result in a reduction in the requirements for resolution and speed of operation.
- ✓ 2.24. Operational and Maintenance Manual--Five copies of an operational and maintenance manual shall be provided with the printer describing operational characteristics as well as normal maintenance and repair procedures.
- 2.25. Machine Size--The printer shall be less than 6' high x 8' long x 3.5' deep in size.

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2.26 Briefing Boards--Briefing boards or artists concepts of the printer will be furnished in accordance with the specifications supplied by the Technical Representative of the Contracting Officer.

✓ 2.27 Full Frame Viewing--Full frame viewing of the frame to be printed will be provided.

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✓ 3. TEST PROVISIONS

- ✓ 3.1. Test Plan--Sixty (60) days prior to completion of the printer the contractor shall submit a detailed test plan to the project monitor for approval. The test plan shall specify and describe tests to be conducted at the contractor's plant to determine conformance to the requirements. The project monitor reserves the right to modify or amplify the test plan to assure adequate testing.
- ✓ 3.2. Furnishing of Test Targets, Films, and Instruments--All test targets, test films, and test instruments necessary to demonstrate and test fulfillment of performance requirements of the printer shall be provided by the contractor.
- ✓ 3.3. Pre-Shipment Tests--Prior to delivery, tests as set forth in the test plan shall be conducted by the contractor at the contractor's plant under the direction of the contract monitor. All materials and equipment required for tests shall be furnished by the contractor and shall be approved by the contract monitor. A detailed report of the test results shall be delivered with the printer. Approval of pre-shipment test results shall not constitute final acceptance of the printer.



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- ✓ 3.4. Acceptance Tests--Acceptance tests will be performed at the delivery destination and will include a 30-day period of normal operation under production conditions.

✓ 4. DELIVERY

Delivery shall be as specified in the procurement document.